

Appl. No. 10/720,325  
Examiner: Sarkar, Asok K, Art Unit 2891  
In response to the Office Action dated May 10, 2005

Date: August 10, 2005  
Attorney Docket No. 10113251

## REMARKS

Applicant thanks the Examiner for acknowledging Applicant's claim to foreign priority and receipt of the certified copy of the priority document. Responsive to the Office Action mailed on May 10, 2005 in the above-referenced application, Applicant respectfully requests amendment of the above-identified application in the manner identified above and that the patent be granted in view of the arguments presented. No new matter has been added by this amendment.

### Present Status of Application

Claims 1, 11, and 13 are rejected under 35 U.S.C. 102(b) as being unpatentable by Hsiao (US 6,291,286). Claims 12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsiao in view of Shrems (US 6,008,104). Claims 2-10 are objected to as being dependent upon a rejected base claim but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 15-22 are allowed.

In this paper, claim 1 is amended to recite, *inter alia*, that a portion of the second conductive layer is isolated from the semiconductor substrate by a second portion of the collar insulating layer. Support for amended claim 1 can be found on pages 5-10 and FIGS. 2-9 of the application. More particularly, support for the amendment can be found on page 9, lines 19-22 and FIG. 8 of the application. Claim 2 is amended to correspond with the amendment to claim 1. Claims 23-28 are canceled. New claim 29 is added. Support for newly added claim 29 can be found, for example, on pages 5-10 and FIGS. 2-9 of the present application. Thus, on entry of this amendment, claims 1-22 and 29 remain in the application.

Reconsideration of this application is respectfully requested in light of the amendments and the remarks contained below.

### Allowable Subject Matter

Applicant thanks the Examiner for his allowance of claims 15-22 and his indication that claims 2-10 would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims.

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Rejections Under 35 U.S.C. 102(b)

Claims 1, 11, and 13 are rejected under 35 U.S.C. 102(b) as being unpatentable by Hsiao. To the extent that the grounds of the rejections may be applied to the claims now pending in this application, they are respectfully traversed.

To anticipate a claim, a reference must teach every element of the claim. In this regard, the Federal Circuit has held:

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

"The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

As amended, claim 1 recites a method of fabricating a trench device structure with a single-side buried strap including the steps of 1) removing a first portion of the collar insulating layer from the deep trench to expose a first portion of the semiconductor substrate while a second portion of the collar insulating layer remains to isolate a second portion the semiconductor substrate, and 2) forming a second conductive layer overlying the first conductive layer in the deep trench, wherein the second conductive layer is lower than the surface of the semiconductor substrate and a portion of the second conductive layer is isolated from the semiconductor substrate by the second portion of the collar insulating layer.

Thus, the method recited in claim 1 includes the step of removing a first portion of the collar insulating layer from the deep trench to expose a portion of the semiconductor substrate while leaving a remaining second portion of the collar insulating layer to isolate the semiconductor substrate. Since the second portion of the collar insulating layer remains, a portion of the second conductive layer is isolated from the semiconductor substrate thereby.

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However, as disclosed by Hsiao in column 4, lines 57-62 and FIGS. 3-4:

Referring now to FIG.3, a third polysilicon layer 58 is deposited overlaying the dielectric collars 52 and second polysilicon stud 54 inside the trench. Finally, a shallow trench isolation (STI) layer 60 is formed overlaying the third polysilicon layer 58 to complete a buried strap formation of trench capacitor as shown in FIG.3.

Thus, the third polysilicon layer 58 recited in Hsiao is formed overlaying the dielectric collars 52 and both sides of the third polysilicon layer 58 directly contact the substrate. See FIGS. 3-4 of Hsiao. There is no teaching or suggestion that a portion of the second conductive layer is isolated from the semiconductor substrate by the second portion of the collar insulating layer, as recited in claim 1. Accordingly, Applicant submits that the method recited in claim 1 patentably distinguishes over the dielectric collars 52 in Hsiao since the dielectric collars 52 do not isolate the third polysilicon layer 58 from the semiconductor substrate.

For at least the reasons described above, it is Applicant's belief that Hsiao fails to teach or suggest all the limitations of claim 1. Applicant therefore respectfully requests that the rejection of claim 1 be withdrawn and the claim passed to issue. Insofar as claims 2-14 depend from claim 1 either directly or indirectly, and therefore incorporate all of the limitations of claim 2-14, it is Applicant's belief that these claims are also in condition for allowance.

Rejections Under 35 U.S.C. 103(a)

Claims 12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsiao in view of Shrems (US 6,008,104).

As noted above, it is Applicant's belief that claims 12 and 14 are allowable by virtue of their dependency from claim 1. For this reason, the Examiner's arguments in connection with these claims are considered moot and will not be addressed here.

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New Claim 29

New claim 29 recites a method of fabricating a trench device structure with a single-side buried strap comprising the steps of providing a semiconductor substrate having a deep trench therein; forming a buried trench capacitor in a lower portion of the deep trench; forming a collar insulating layer lining an upper portion of the deep trench; forming a first conductive layer overlying the buried trench capacitor in the trench and surrounded by and lower than the collar insulating layer by a predetermined height; removing a portion of the collar insulating layer from the deep trench to expose a portion of the semiconductor substrate; forming a second conductive layer overlying the first conductive layer in the deep trench, wherein the second conductive layer is lower than the surface of the semiconductor substrate; **and performing a thermal treatment to form a buried strap region on the semiconductor substrate directly contacting the second conductive layer without isolation by the collar insulating layer.**

Applicant respectfully submits that the references cited by the Examiner do not teach or suggest at least the features emphasized above. Namely, Hsiao teaches that a two-step ion implantation is performed to form the shallow strap and deep strap regions on one side of the trench. See column 4, lines 14-16 of Hsiao. Therefore, Applicant respectfully asserts that claim 29 is in condition for allowance.

Conclusion

The Applicant believes that the application is now in condition for allowance and respectfully requests so.

Respectfully submitted,



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